DISCRETE ELEMENT METHOD SIMULATIONS OF GELDART GROUP A PARTICLES IN A MICRO FLUIDIZED

Tingwen Li, National Energy Technology Laboratory; AECOM, Morgantown, USA
tingwen.li@netl.doe.gov
Vikrant Verma, National Energy Technology Laboratory, Morgantown, USA
Jean-François Dietikera, West Virginia University Research Corporation, Morgantown, USA
William Rogers, National Energy Technology Laboratory, Morgantown, USA
Swapna Rabha, National Energy Technology Laboratory, Morgantown, USA
Balaji Gopalan, West Virginia University Research Corporation, Morgantown, USA
Greggory Breaulta, REM Engineering Services, Morgantown, USA
Jonathan Tuckera, West Virginia University, Morgantown, USA
Rupen Pandaya, REM Engineering Services, Morgantown, USA

The Geldart Group A particles are of great importance in various chemical processes owning to advantages such as ease of fluidization, large surface area. However, it is very challenging to model the fluidization behavior of such particles as reported in the literature. To help address some challenges in modeling Group A particles, experiments were conducted in a rectangular acrylic column with width of 5 cm, height of 43 cm and depth of 0.32 cm at National Energy Technology Laboratory (NETL) for detailed measurement of fluidized bed hydrodynamics. Different types of particles were tested in this facility and experimental measurements of pressure drop across the bed, bed expansion, bubble properties, and solid motion were acquired for validation of computational fluid dynamic (CFD) models. This study reports the validation of discrete element method (DEM) in NETL's open source code MFIX using the data from the above mentioned experimental facility. Specifically, sieved FCC particles with a mean diameter of 148 µm and density of 1,300 kg/m3 were simulated using MFIX-DEM. Validation against the experimental data of bubble characteristics and solid movement measured using high speed imaging and high speed PIV were conducted. Efforts were made to ensure consistent post-processing for bubble properties from numerical simulations and experimental images. Effects of different parameters characterizing the particle-particle and particle-wall interactions including spring constant, restitution coefficient, and friction coefficient, were evaluated. In addition, the cohesive inter-particle force, i.e. van der Waals force, was incorporated in the simulation and the influence on numerical results was examined.